

WHAT IS CLAIMED IS:

1. A circulation type liquid helium recondensation device with a contaminant-purging function designed to pump
5 helium gas evaporating from a liquid helium storage tank using a circulating pump, to refine the pumped helium gas in refiners, to liquefy the gas, and to return the liquefied helium to the liquid helium storage tank for recycling, in which said refiners are provided with heaters and also a discharge circuit
10 on the inflow side, and contaminants that vaporize when the refiners are heated by said heaters are pumped and discharged to the atmosphere via said discharge circuit.
2. A circulation type liquid helium recondensation
15 device with a contaminant-purging function as claimed in Claim 1 in which a dedicated purge pump is installed in said discharge circuit to pump and discharge vaporized contaminants to the atmosphere.
- 20 3. A circulation type liquid helium recondensation device with a contaminant-purging function as claimed in Claim 2 in which mass flow controllers are installed on the inflow side of said refiners to control the flow rate of the incoming

helium gas.

4. A circulation type liquid helium recondensation device with a contaminant-purging function as claimed in Claim 5 2 in which two or more valves are installed on the inflow side of said refiners to control the flow rate of the incoming helium gas by combining said valves.

5. A circulation type liquid helium recondensation 10 device with a contaminant-purging function as claimed in Claim 1 in which said discharge circuit is a circuit connecting the inflow side circuit of the refiner and the inflow valve of said circulating pump, and an electromagnetic valve for discharge is installed in said discharge circuit, and another 15 electromagnetic valve for atmospheric discharge is installed on the downstream side of said circulating pump.

6. A circulation type liquid helium recondensation device with a contaminant-purging function as claimed in any 20 of Claims 1 through 5 in which condensing pots are installed to store the refined helium from the refiner as gas or liquid at near-4K temperature, and said condensing pots are provided with heaters.

7. A circulation type liquid helium recondensation device with a contaminant-purging function as claimed in any of Claims 1 through 6 in which said liquid helium storage tank (dewar) is provided with an electromagnetic valve to regulate
5 the pressure of the liquid helium storage tank.

8. A contaminant-purging method for the circulation type liquid helium recondensation device that is employed in the liquid helium recondensation procedure comprising the
10 operating steps of pumping helium gas evaporating from a liquid helium storage tank using a circulating pump, refining the pumped helium gas in a refiner, liquefying the gas, and returning the liquefied helium to the liquid helium storage tank for recycling, in which said refiner is heated to vaporize
15 contaminants deposited on the refiner, and the vaporized contaminants are discharged to the atmosphere.

9. A contaminant-purging method for the circulation type liquid helium recondensation device that is employed in the liquid helium recondensation procedure comprising the
20 operating steps of pumping helium gas evaporating from a liquid helium storage tank using a circulating pump, refining the pumped helium gas in a refiner, liquefying the gas, storing the liquefied helium in a condensing pot, and transferring

the liquid helium from said condensing pot to the liquid helium storage tank for recycling, in which at least either of said condensing pot or said refiner is heated to vaporize the contaminants deposited on the refiner, and the vaporized
5 contaminants are discharged to the atmosphere.

10. A contaminant-purging method for the circulation type liquid helium recondensation device as claimed in Claim 8 or 9 in which said vaporized contaminants are pumped by a
10 dedicated pump and discharged to the atmosphere.

11. A contaminant-purging method for the circulation type liquid helium recondensation device as claimed in Claim 8 or 9 in which said vaporized contaminants are pumped by the
15 circulating pump and discharged to the atmosphere.

12. A contaminant-purging method for the circulation type liquid helium recondensation device as claimed in any of Claims 9 through 11 in which heating of said condensing
20 pot or the refiner starts when the pressure in the refiner rises to a preset level and stops when the pressure falls to a preset level.

13. A contaminant-purging method for the circulation type liquid helium recondensation device as claimed in any of Claims 9 through 11 in which heating of said condensing pot or the refiner starts when the flow velocity in the refiner
5 falls to a preset level and stops when the flow velocity rises to a preset level.

14. A contaminant-purging method for the circulation type liquid helium recondensation device as claimed in any
10 of Claims 9 through 13 in which heating and cooling of said condensing pot or the refiner is performed in the operating mode sequence of heating/back-flow, cooling, circulation recovery, and liquid level recovery.

15 15. A refiner for the circulation type liquid helium recondensation device with a contaminant-purging function designed to pump helium gas evaporating from a liquid helium storage tank using a circulating pump, refine the pumped helium gas in the refiner, liquefy the gas, and return the liquefied
20 helium to the liquid helium storage tank for recycling, in which said refiner is made up of a thermally conductive housing, with contaminant solidification unit installed on the housing, an infeed means to transfer helium gas to said housing, and a heating means to vaporize the contaminants attached to said

solidification unit, and in which the contaminants vaporizing in the refiner are discharged from the refiner to the atmosphere via said infeed means.

5 16. A refiner for the circulation type liquid helium recondensation device with a contaminant-purging function as claimed in Claim 15 in which said contaminant solidification unit is a staggered zigzag passage made up of thermally conductive fins.

10

17. A refiner for the circulation type liquid helium recondensation device with a contaminant-purging function as claimed in Claim 15 or 16 in which said infeed means is supported on the housing via a component that reduces the
15 thermal gradient.

18. A helium gas refiner as claimed in Claim 17 in which said component to reduce the thermal gradient is a stainless steel bellows component.

20

19. A transfer tube for a circulation type liquid helium recondensation device designed to pump helium gas evaporating from a liquid helium storage tank using a circulating pump, refine the pumped helium gas in a refiner, liquefy the gas,

and return the liquefied helium to the liquid helium storage tank for recycling, in which said transfer tube comprises a tube for flowing liquid helium at about 4K (near-4KL) at the center, another for flowing liquid helium gas at about 4K
5 (near-4KG) coaxially arrayed outside the central tube, and the other for flowing liquid helium gas at about 40K coaxially arrayed outside the second tube, and in which a vacuum insulation layer is formed between adjacent tubes and outside the most external tube.

10

20. A transfer tube for the circulation type liquid helium recondensation device as claimed in Claim 19 in which heaters are connected to the tip of the vacuum insulation layer provided between the near-4K liquid helium tube and the
15 coaxially arrayed near-4K liquid helium gas tube and at the tip of the vacuum insulation layer provided outside and around the near-40K liquid helium gas tube.